Michigan Hazard Mitigation Plan:
Risk and Vulnerability Assessments

General Development Process for the Hazard Analysis Section

Since the previous edition of the Michigan Hazard Mitigation Plan was completed and adopted in March of 2011, it was recognized that the 2014 update needed to allow more time for such a large plan to be reviewed by all relevant agencies and their subject matter experts. In order to solve this problem, the hazard analysis section was updated during 2011 and 2012. A period of three years is not particularly long when it comes to updating a plan that is more than 900 pages long, but since more than 400 pages of it is composed of the hazard analysis sections, and since a separate, updated edition of the Michigan Hazard Analysis (MHA) had not been completed since 2006, it was decided that both an update of this half of the MHMP as well as a new edition of the MHA could be accomplished at the same time, leaving quite a bit of remaining time available to update the remainder of the MHMP in time for its deadline in 2014. The inclusion of a full range of hazards—natural, technological, and human-related—was retained for the July 2012 MHA as well as the March 2014 MHMP. However, since nearly two years would have passed between the newest edition of MHA and the March 2014 MHMP deadline, additional updates were clearly necessary in the hazard analysis sections of this plan. These updates were successfully made during the 2013-2014 period, led by MSP/EMHSD staff but with input from other agencies and information sources. This process worked decently enough that an updated edition of the MHA is again planned for about half-way through the MHMP update cycle (currently three years, but ideally five years, if regulations are legislatively changed to allow more time for this work).

In 2011, the MHMP format was amended to allow a single, integrated document rather than the smaller core document (used previously) that then referred to various other publications and attachments. This format has been retained for the 2014 update. Various ways to improve the MHMP format were considered, especially regarding ways to have the state plan more closely resemble the required format for local plans (as a way to assist with making the development of local plans easier), but there was insufficient time (staff resources) available to bring these ideas to realization, in part because of the work needed for disaster 4121 in 2013, but also because of time needed to comply with new federal requirements to submit an annual Threat and Hazard Identification and Risk Assessment (THIRA) and State Preparedness Report (SPR), these latter two being found to be frameworks that were too artificial in their design to carry well into the extensive hazard analyses that have been cumulatively developing for more than 15 years in Michigan's planning documents—analyses that have proven useful over many years, at both a state and local level.

In addition to the process of MSP/EMHSD personnel's own review, research, and work upon the 2012 MHA and 2014 MHMP updates, months of outreach, feedback, information and material review was contributed by numerous partnering agencies and stakeholders. These have been documented in the preceding section of the plan, in the multi-page listing of "Input Agencies and Processes: 2014 Michigan Hazard Mitigation Plan Update." Rather than repeat that information, or the preceding "Section by Section Summary of Changes," this current section of the plan will instead provide, in narrative form, an overview of the philosophy, general process, and methods by which the coordinated efforts of these many contributors were integrated into the 2012 MHA and 2014 MHMP update.

There is always the necessity, in any major planning process, of having a core team that is responsible for compiling and assessing information, evaluating proposed changes, and doing the actual final editing of the resultant document. MSP/EMHSD personnel acted as that core team, while interagency oversight and input opportunities were maintained by the MCCERCC, and its hazard mitigation committee. Some of the earliest preparation for the 2014 MHMP update process came in the form of MCCERCC agency review (and networking to partner agencies) of the MHA sections in this plan. Progress on MHA and MHMP updates were reported at meetings of MCCERCC and its committees, as a periodic task with which the MCCERCC had been charged by the governor with a key role. MCCERCC members either directly reviewed, or identified known subject matter experts to review, the details of information and text within the hazard analysis and plan. Additional organizations were informed and provided with an opportunity to review and provide feedback on the 2014 MHMP, which had not been involved in 2011. These included the Michigan Climate Coalition and the (now more active) Silver Jackets group in Michigan. After the initial information process was presented by MSP/EMHSD planning staff at various meetings, carefully chosen personnel within MSP/EMHSD proceeded to follow up individually with the agencies that possessed relevant expertise, and additional contact persons

and subject matter experts were sought out among universities, authors, web sites, etc. when considered appropriate. For example, authorities from Michigan State University and the University of Michigan (Ann Arbor) were asked to review sections of the hazard analysis or to answer specific questions. Author and meteorologist Paul Gross again graciously agreed to review weather-related sections and new/revised text about recent and anticipated climate change impacts upon Michigan's hazards and vulnerabilities. Subject matter experts who were contacted by MSP/EMHSD were sent information about the hazards and sections of the plan that were considered to be most relevant to their expertise. Feedback took many forms, but most of the information received by MSP/EMHSD was in a form that directly related to specific changes that could be made to the existing text within the plan. For example, typed email responses or revised documents from sections of the MHA and MHMP. Changes in the state documents were made as soon as possible, so that a revised version of the amended section could receive as much further review as was possible before the plan's official expiration date at the end of March 2014. For the first time, popular online/wireless social media was used by MSP to publicize the MHMP update and refer readers to the EMHSD web site where draft materials could be reviewed and comments sent to the plan editing staff.

The initial focus upon technical details of the hazard analysis then shifted to an evaluation and review of larger sections within the plan, in consultation with the MCCERCC hazard mitigation committee. Finally, a full draft plan was distributed to MCCERCC and its hazard mitigation committee for their review and approval in March 2014. These sections were simultaneously provided to FEMA (and also available on two MSP/EMHSD websites). Thus, the input of various agencies since 2011 was gradually consolidated into successive refinements in the draft plan until, by March 2014, a full draft was able to be formally agreed to by the MCCERCC and found to have met the planning requirements stemming from the Disaster Mitigation Act of 2000. (Any feedback or corrections received too late to be a part of that process will nevertheless be retained by MSP/EMHSD as feedback for consideration under subsequent review and evaluation as the new planning cycle from 2014 to 2017 is entered.)

The reformatting of the hazard analysis portion of the 2014 plan, into a separate stand-alone document (EMHSD Pub. 103) will allow it to serve as an attachment to other state documents, most notably including the Michigan Emergency Management (response) Plan. Any feedback about the MHMP that was not able to be considered for the March 2014 update deadline, can help to refine subsequent documents that are closely related, without waiting until the (March 2017) end of the next MHMP planning cycle to be utilized. This is especially worth noting here since some of the feedback obtained in 2014 might be considered out-of-date by 2017, but any such feedback after the March publication of the 2014 MHMP update is still likely to be put to good use in 2015 (MHA), and through these related documents which are also overseen by many of the same MSP/EMHSD planning personnel who were involved in the development, research, writing, and editing of the MHMP.

The stakeholders for each hazard-specific section of the MHMP were defined in terms of their expertise in the hazard, or in hazard-related measures, activities, programs, and initiatives. Stakeholders included the "steward" agency or organization for the hazard in question within Michigan's government, or at a federal level, or in an associated non-governmental organization (or an academic institution). Most of Michigan's state departments were considered to be stakeholders. In some cases, a federal agency (e.g. U.S. Geological Survey) was identified as a stakeholder. There were also subject matter experts who were contacted in other agencies and academic institutions for information, advice, and recommendations during this process. In some cases, organizations had contributed to the plan without traditional interaction, by posting information upon a web site that provided the insight that was needed. Even in these cases, however, a valuable enough web page tended to eventually prompt MSP/EMHSD planning personnel to contact a representative at the organization for more insight or assistance in the sources, applications, and limitations of the data that had been provided online.

Most of the burdens placed upon the stakeholder/partnering agencies involved the review of previously-developed chapters about specific hazards. In many cases, the agency was already generally familiar with the material, due to its involvement as a stakeholder in previous MHMP planning cycles. In other cases, text was newly written or completely revised and therefore had to be considered afresh. The review of each section served to ensure that the basic tone, reasoning, direction, content elements, and implications of the analysis were generally sound, as well as to correct any specific factual or typographic errors, and to add new descriptions of hazard events. In some cases, new maps and data had to be supplied by these reviewing agencies. The emphasis was on an accurate presentation of the nature, scope, magnitude, and actual/potential impacts of each hazard upon Michigan, and means to guard against the hazard, including the identification of any programs or initiatives not already described in previous versions of the section.

Input was also accepted regarding recommendations to improve the organization of a section, or to try to seek a better methodological approach to the topic to the extent that time and resources allow in future updates. The most problematic section may still be that for the Invasive Species hazard, so a different approach may be sought for the next edition of the MHA.

Hazard analysis sections that were new (or completely revised) in the 2011 edition were able to be substantially improved in this 2014 edition. Several typographic and grammatical errors, for example, were corrected in the Celestial Impact section, and an expanded treatment of cyber-attacks was added to the Terrorism section. Tables compiling historical information from the National Climatic Data Center for each Michigan County were able to be added into the updated 2014 edition, and thus to inform the overall summary table at the start of the analysis, which compares different types of hazards in terms of their average annual impacts. Every section in this plan has had serious thought put into it, and will continued to be assessed for relevance and accuracy in the future. Unfortunately, due to staff changes involved around the 2006 MHA, and the lack of a precise footnoting system in earlier editions of this document, full citations for all information have not been possible. The format established for the core documents in the 1990s had included a full list of citations, but without footnotes to denote precisely which information each source was used for, it became impossible to keep track of which sources had become outdated as the years passed and numerous new editions were produced. In addition, by 2011 it had become clear that many information sources for recent hazard events were those recorded online in rapidly-changing or archived websites, which would rapidly become inaccessible—sometimes mere weeks after they had initially been accessed. The recent solution to these problems has been to include in each new update some references to the main information sources, while readers can make use of internet search engines to verify (if needed) details of various hazards listed in the event descriptions throughout the hazard analysis. It is common that for each event, several web articles may be found, some of which may differ in certain details. Again, if corrections or additions seem to be needed in any part of this document, feedback is welcome and should be sent to Mike Sobocinski at sobocinskim@michigan.gov (or by phone at 517-336-2053). Every page of the MHMP was reviewed, and numerous clarifying changes in wording were common, even in cases where the essential information remained the same since 2011.

In all cases, whether through the update of a pre-existing hazard section or the development of an entirely new section, the overall goal is for the document to provide a current, comprehensive, accurate, and balanced "portrait" of Michigan's hazards, and for the quality of the work to be as good as possible within the constraints of available staff time, agency resources, and existing expertise.

The overall update process, in one sense, started as soon as the previous edition of this plan had been completed, approved by FEMA, and adopted officially by the state of Michigan. Even as other types of work were undertaken, the relevance of the material in the MHMP would often be recalled and considered in the light of new information obtained through local plans, meetings, feedback and questions at workshops, presentations, etc. In addition, the plan review standards for the Emergency Management Accreditation Program (EMAP) were kept in mind for this MHMP update, since a renewal of Michigan's accreditation will be due before the next update of this plan in 2017. For example, the "consequence analysis" sections have been included for each hazard (e.g. impact of each hazard upon public confidence) and a special section related to this has also been updated with new survey information, in order to meet EMAP requirements as they stood in 2013.

Since several of the key MSP/EMHSD planning personnel on the core writing/editing team have also been involved in the production and review of Michigan's many local hazard mitigation plans, a knowledge of these local plans was able to be integrated into the expansion of the lengthy lists of historical incidents, the identification of which counties had identified particular hazards as locally most significant, and so on. (In turn, the new information and methods developed through this 2014 MHMP update will be shared with local planning and emergency management personnel as outreach, training, coordination, plan review, guidance, and direct assistance activities take place throughout the state during the 2014-2017 cycle of the MHMP.) This document has been designed to allow its text to be searchable by county name, therefore allowing the developers of local plans (or plan updates) to conveniently find all references to a specific Michigan county. In most Windows applications, using the "Ctrl" and "F" keys together will open up a search window ("Find…") and the name of the county can be typed into this window in order to locate all references that appear in this plan. Local planners are encouraged to make free use of this information in the development and update of the local hazard mitigation plans (or other types of relevant plans) they are working on.

Analysis of Michigan's Hazards for the 2014 MHMP Update: Format Used

As in the previous plan, the hazard analysis chapters instead now fit into three large sections according to their general classification as natural, technological, or human-related hazards. In some cases, hazards that are very closely related have some of their relevant features and mitigation strategies described in introductory material for an overarching section (e.g. thunderstorm hazards, hazardous materials) rather than solely within each of the most specific chapters (e.g. lightning, severe winds). A fairly consistent and consolidated organization of the information within each of its many chapters has been sought, and the largest change in this might be seen within the updated section on riverine flooding, which has now been made more consistent with this standard format than it had been in previous plans. The standard organization chosen for most (but not all) of the chapters involve the following subsections for each hazard (where enough research has accumulated to allow all of these sections to be developed and included): (1) Hazard Description, (2) Hazard Analysis, (3) Significant Historical Events, (4) Programs and Initiatives, (5) Mitigation Alternatives, and (6) Tie-In with Local Hazard Mitigation Planning. Each of these subsections is further described below, and is intended to help (A) clearly identify for FEMA and EMAP reviewers where to find each of the elements required under their plan review standards, and (B) to help move toward a similar or parallel formatting that the developers of local hazard mitigation plans may find convenient to use.

Hazard Description

Each hazard is describer in a manner that explains its nature to both the general public and to more specialized readers. Federal review standards under the Disaster Mitigation Act of 2000 require this element for all significant natural hazards, in hazard mitigation plans both at the state and the local level. Local developers of hazard mitigation plans (or those reviewing such a plan as part of an update process) may freely make use of these descriptions in their own plans. This type of original material, written specifically for the MHMP, is freely available for use by local governments, without concerns regarding copyright or permission. (In order to promote coordination between state and local plans, however, the local plan should include the fact that it made use of this MHMP during its development or review process, in compliance with a different federal requirement that the local plan describe the review and incorporation of existing plans.)

Hazard Analysis

The diversity of the hazards in this plan precluded a totally standardized approach to their analysis, but the hazard analysis for each chapter has tended to make use of the best available information to try to consider all of the aspects of each hazard that are most relevant, as well as to try to cover all of the FEMA risk assessment requirements and EMAP consequence analysis requirements. In addition to various vulnerabilities, each chapter tends to include the following:

(1) Location: For hazards that vary significantly in their impacts or frequency from one part of the state to another, the locations of these different risks tend to be analyzed either through the use of maps or tables or the detailed description of historical events. Some hazards have a longer history of occurrences than others, and the amount of detail that is conveniently available in known data sources is also quite variable. Some hazards are more amenable to spatial analysis than others. Nevertheless, one of the basic ideas for local planners, emergency managers, or plan reviewers to make note of is that this feature of the MHMP analysis typically allows a local analyst to peruse the plan for specific information about the county or region of the state for which a local plan must be made or reviewed. This element is required for both state and local plans to pass federal review, but the amount of local detail will naturally be greater in the local plans. Typically, the MHMP will describe geographic variation in hazards down to the county level, and the local hazard mitigation plans (which are typically produced by county-level emergency management programs) should provide location information down to the level of the minor civil division, the floodplain, or even specific sites, for hazards that are considered to be locally significant. This is especially important because a hazard (i.e. a small floodplain area) might be too small to show up on a state-level map, yet may result in disaster-level damages and harm.

(2) Probability/frequency of future events: For most hazards, the probability or frequency of future events is estimated from the recorded history of past significant events (see below). A probability may be very difficult to calculate, as in the engineering calculations that underlie the Flood Insurance Rate Maps which designate recognized flood areas that have a calculated 1% annual probability of reaching or exceeding a particular flood level. Since most persons do not have a great deal of training in probability theory, yet may have valuable information about area hazards that should be included in a plan, it is also acceptable to describe hazards in terms of their expected frequency. For example, snow falls every year throughout Michigan, which translates to an annual probability of 100%, but it is much more relevant to refer to the number of snowstorms per year in different areas, rather than leaving things with a simple statement that

every area does receive snow. In this way, differences between geographic locations can more meaningfully be assessed through the use of estimated frequencies of occurrence rather than probabilities, and the frequency of occurrence can easily be estimated through an ordinary mathematical procedure in which the number of significant hazard events is divided by the number of years in the historical records. For example, 50 snowstorms over a 10 year period results in an annual expected frequency of 5 snowstorms per year. (By definition, a "probability of occurrence" does not ever exceed 100%, and the mathematical procedures for estimating probabilities can quickly become complicated.) For a second example, if 10 tornadoes occur during a 50 year period, then the annual expected frequency of tornadoes is 0.5 or ½, which (taking the reciprocal) can also be expressed as about 1 event every 2 years, on average. In this way, <u>all</u> hazards can readily be compared with each other, but caution must be used before the risk from any hazard is declared to be "zero" if there are no recorded events in an area. Rather, a theoretical approach should be used to estimate the likelihood of events that <u>could</u> happen in an area, even if they haven't yet been observed there (e.g. terrorism). One might look at the history of similar areas in order to produce such an estimate. Various techniques like this have been employed throughout the MHMP, as considered appropriate for the consideration of each type of hazard. **The summary table at the start of the Hazard Analysis section provided the most convenient way to present this information.**

Technical note: Mathematically, a probability and a frequency differ significantly although esoterically from each other in various ways. The probabilistic concept of the "chance of occurrence" is more difficult to calculate and is more likely to be misinterpreted by non-specialist readers. For example, a "base flood" has a 1% chance of occurrence per year—a probability that has been calculated by engineers or scientists after expensive and time-consuming field measurements. Over a 100-year period, however, the cumulative chance of a flood occurring within that area is <u>not</u> 100%, as many laypersons might guess, but only 63.4%, due to the mathematical rules that apply to a sequence of conditional 0.01 probabilities over the course of 100 years: $1 - 0.99^{100}$. Similarly, one person may express a historical record of one event every 100 years as equaling a 0.01 chance of occurrence, but another person may try to use that same technique in a case where 200 wildfires had occurred over the same 100 years and wrongly state that wildfires have a 200% chance of occurrence—a value that violates the basic principles of a probability function, and the very definition of a probability. In addition, it is quite possible for a 0.01 probability flood to occur many times within a 100-year period, just as it is possible to occasionally get "lucky" and roll several "snake eyes" in a row on a pair of dice, or to flip a coin numerous times and have it land on "heads" every time. Rather than deal with the technical mathematical distinctions between these concepts and those involving conditional probabilities (often useful to determine cumulative likelihoods or combinations of events that each have different individual probabilities), probability functions (a graph whose analysis requires either specialized tables, computers, or the use of calculus), or the determination of algebraic inverse functions (to reverse the steps used in a probabilistic algorithm like the one used in the flood example above), the most straightforward means of describing these concepts is instead recommended—a frequency of occurrence in the form of the expected (average) number of hazard events per year.

(3) The extent (magnitude, severity, intensity) of the hazard: This element is required for the analysis in local hazard mitigation plans, but has also been included here. Not only is it vital for the analysis of many hazards, but will also provide at least some of the information that local plan reviewer or developers will need for their own plans. Where intensity scales (e.g. Enhanced Fujita) or intensity categories (e.g. advisories or warnings) have been defined by recognized authorities on a particular hazard, these helpful devices have been described in the MHMP.

(4) The impact of each hazard: This element is not only required for all local plans, but is also required by EMAP for a state-level plan to comply with its accreditation standards. Furthermore, an EMAP-compliant state must describe each hazard in terms of its impact upon (a) the public, (b) emergency responders, (c) continuity of operations including continued delivery of services, (d) property, facilities, and infrastructure, (e) the environment, (f) the state's economy, and (g) public confidence in state governance. Four of these requirements have been given their own specific subsections within the hazard analysis portion of the hazard chapters in the plan. Furthermore, a special section provides an overarching overview of the potential impact of Michigan's hazard upon public confidence in government.

<u>Significant Historical Events</u>
This component is required for both state and local plans, and not only provides sufficient detail to allow many local jurisdictions to use within their own plans, but also tends to include various impact, intensity, and location information.

<u>Programs and Initiatives</u>
Provides a useful guide for resources that could address or mitigate vulnerabilities identified in the hazard analysis.

<u>Hazard Mitigation Alternatives</u>
Another guiding step to lead readers and analysts into a consideration of possible mitigation activities that might be useful for the types of vulnerabilities described in the hazard analysis. In this edition of the MHMP, however, numerous listings have been removed if they seemed to not to be especially close to the "mitigation" phase of emergency management, as federally defined ("sustained action taken to reduce or eliminate long-term risk to people

and their property from hazards"). In effect, preparedness activities have been de-emphasized in order to more strongly suggest what types of projects are more likely to qualify for FEMA hazard mitigation funding.

Tie-In with Local Hazard Mitigation Planning

On the one hand, this section includes references to local hazard mitigation plans which have been reviewed by MSP/EMHSD personnel. On the other hand, useful advice is given to those involved in local-level planning. For more information about local hazard mitigation planning standards: http://www.fema.gov/hazard-mitigation-planning-resources.

Hazard Mitigation Alternatives

The identification of risks and vulnerabilities should lead planners directly to a consideration of various hazard mitigation alternatives that might be applied to improve the safety and security of residents, property, the environment, the economy, and quality of life. A hazard mitigation alternative is not the same as a project or specific action that will definitely be implemented. Rather, an alternative is one of a potential set of actions or strategies that will be evaluated and compared with each other. An evaluation process will involve more than one agency, will take into consideration feedback from the public, legal limitations, economic constraints, and so on. Usually, however, the eventual result is the identification of one or more specific actions that can (and should) be undertaken to improve conditions for all or part of the planning area. The introductory section of this plan gave an overview of various general types of hazard mitigation actions. After an extensive consideration of numerous hazards that can affect Michigan, this plan will later present an array of carefully selected hazard mitigation objectives, which have received multi-agency approval for their appropriateness and feasibility, cost-effectiveness, legal defensibility, and so on. But such specific objectives stemmed from a consideration of a variety of mitigation alternatives, both general and specific in nature.

In this subsection of the plan, an array of hazard mitigation alternatives is presented. Some of these alternatives (such as zoning decisions) are more appropriate for local implementation, and the state's role would be to try to promote the consideration of these hazard mitigation strategies in local hazard mitigation plans. Other alternatives (such as legislation) are more appropriate for implementation by state government. Some alternatives may involve the participation of multiple actors at different levels (local, state, and federal; public, private, and non-profit). An example of such a hazard mitigation idea could be an improvement in a local community's drainage infrastructure that obtains federal grant funds (administered by a state agency) and makes use of matching funds from a local community foundation, while providing benefits to downstream areas in the watershed region as well. These types of very specific projects usually stem from hazard the mitigation actions found in local hazard mitigation plans, which are usually produced in coordination with State and Federal agencies (the Michigan State Police Emergency Management and Homeland Security Division, and the Federal Emergency Management Agency).

Some portions of the following lists of mitigation alternatives also appear in later sections of this plan, but because there are some items that serve multiple functions in alleviating harm and risks from numerous hazards, an extensive list of alternatives is initially presented for here. The list was considered by planners at the state level, but is also intended for consideration by planners and emergency managers in regional and local jurisdictions.

Although "hazard mitigation" is often presented as if it is something entirely distinct from "preparedness, response, and recovery," (known together as the four phases of emergency management), and although one form of hazard mitigation is prevention, state planners in Michigan have usually opted not to try to place clear limits or distinctions around the hazard mitigation strategies listed here, since all phases of emergency management share the same ultimate goals of protecting life and property, etc. Many of the hazard mitigation strategies listed in state guidance documents may seem to include preparedness activities, and it has been widely recognized that many hazard mitigation activities can occur most easily during a period of recovery from a disaster (for example, rebuilding to a higher standard). However, the strategies now included here were selected from the broader lists previously published, in order to emphasize the kinds of activities that are closer to how FEMA has defined hazard mitigation, and thus to encourage more readers of this plan (and developers of local hazard mitigation plans) to have a better chance of recognizing and gaining FEMA grant eligibility for their project ideas. Additional activities may potentially help to save lives and protect communities and important agencies, beyond what are listed here as the ideas that are closer to "pure" hazard mitigation actions. After all, in the final selection of strategies for any hazard mitigation plan, care should be taken to ensure the inclusion of at least some strategies that are clearly hazard mitigation. That is, a "pure" hazard mitigation

strategy is an effort to prevent hazard impacts, or to take advance, proactive steps toward the long-term reduction of the impacts of hazards on a community. Some of these may take place during the response or recovery phases of a disaster, not just before an event (since no sooner does one event end than another one may begin, and therefore anything that is done is always potentially in advance of some future hazard event). The narrower, more specific view of hazard mitigation often does need to be taken into consideration, to meet certain grant eligibility requirements.

That being said, an extensive list of hazard mitigation alternatives is hereby presented for general consideration, and has been organized by hazard types, in approximately the same order that the hazards will be analyzed in later sections of this plan. Some hazards that are relatively new to this type of planning do not yet have a clearly established set of hazard mitigation strategies, but it is anticipated that this list will be refined in the future.

I. Natural Hazards

A. WEATHER HAZARDS

Thunderstorm Hazards (General)

- Increased coverage and use of NOAA Weather Radio.
- Public early warning systems and networks.
- Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
- Buried/protected power and utility lines. (NOTE: Where appropriate. Burial may cause additional problems and costs in case of breakage, due to the increased difficulty in locating and repairing the problem.)

Hail-specific (in addition to the General Thunderstorm Hazards list)

- Moving vehicles into garages or other covered areas.
- Inclusion of safety strategies for severe weather events in driver education classes and materials.
- Purchase of insurance that includes coverage for hail damage.
- Using structural bracing, window shutters, laminated glass in window panes, and impact-resistant roof shingles to minimize damage to public and private structures.

Lightning-specific (in addition to the General Thunderstorm Hazards list)

- Using surge protectors on critical electronic equipment.
- Installing lightning protection devices on the community's communications infrastructure.

Severe Winds and Tornadoes (in addition to the General Thunderstorm Hazards list)

- Using appropriate wind engineering measures and construction techniques (e.g. structural bracing, straps and clips, anchor bolts, laminated or impact-resistant glass, reinforced entry and garage doors, window shutters, waterproof adhesive sealing strips, and interlocking roof shingles) to strengthen public and private structures against severe wind damage.
- Proper anchoring of manufactured homes and exterior structures such as carports and porches.
- Securing loose materials, yard, and patio items indoors or where winds cannot blow them about.
- Construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.

Winter Weather Hazards (General)

- Increased coverage and use of NOAA Weather Radio.
- Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
- Buried/protected power and utility lines, where appropriate.
- Establishing heating centers/shelters for vulnerable populations.

Ice and Sleet Storms (in addition to the General Winter Weather Hazards list)

- Home and public building design and maintenance to prevent roof and wall damage from "ice dams."

Snowstorms (in addition to the General Winter Weather Hazards list)

- Proper building/site design and code enforcement relating to snow loads, roof slope, snow removal and storage, etc.
- Agricultural activities to reduce impacts on crops and livestock.
- Pre-arranging for shelters for stranded motorists/travelers, and others.
- Using snow fences or "living snow fences" (rows of trees or vegetation) to limit blowing and drifting of snow over critical roadway segments.

Extreme Temperatures

- Organizing outreach to vulnerable populations during periods of extreme temperatures, including establishing and building awareness of accessible heating and/or cooling centers in the community, and other public information campaigns about this hazard.
- Increased coverage and use of NOAA Weather Radio.

B. HYDROLOGICAL HAZARDS

Riverine, Shoreline, and Urban Flooding

- Flood plain (and coastal zone) management – planning acceptable uses for areas prone to flooding (through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
- Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
- Dry floodproofing of structures within known flood areas (strengthening walls, sealing openings, use of waterproof compounds or plastic sheeting on walls).
- Wet floodproofing of structures (controlled flooding of structures to balance water forces and discourage structural collapse during floods).
- Elevation of flood-prone structures above the 100-year flood level.
- “Floating” architectural designs for structures in flood-prone areas
- Construction of elevated or alternative roads that are unaffected by flooding, or making roads more flood-resistant through better drainage and/or stabilization/armoring of vulnerable shoulders and embankments.
- Government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
- Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.).
- Protection (or restoration) of wetlands and natural water retention areas.
- Obtaining insurance. (Requires community participation in the NFIP.)
- Joining the National Flood Insurance Program (NFIP). **VERY IMPORTANT!**
- Participation in the Community Rating System (CRS).
- Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, wetlands protection and restoration).
- Higher engineering standards for drain and sewer capacity, or the expansion of infrastructure to higher capacity.
- Drainage easements (allowing the planned and regulated public use of privately owned land for temporary water retention and drainage).
- Installing (or re-routing or increasing the capacity of) storm drainage systems, including the separation of storm and sanitary sewage systems.
- Farmland and open space preservation.
- Elevating mechanical and utility devices above expected flood levels.
- Flood warning systems and the monitoring of water levels with stream gauges and trained monitors.
- Increased coverage and use of NOAA Weather Radio.

- Anchoring of manufactured homes to a permanent foundation in flood areas, but preferably these structures would be readily movable if necessary or else permanently relocated outside of flood-prone areas and erosion areas.
- Control and securing of debris, yard items, or stored objects (including oil, gasoline, and propane tanks, and paint and chemical barrels) in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs.
- Back-up generators for pumping and lift stations in sanitary sewer systems, and other measures (alarms, meters, remote controls, switchgear upgrades) to ensure that drainage infrastructure is not impeded.
- Detection and prevention/discouragement of illegal discharges into storm-water sewer systems, from home footing drains, downspouts and sump pumps.
- Employing techniques of erosion control in the area (bank stabilization, planting of vegetation on slopes, creation of terraces on hillsides).
- Increasing the function and capacity of sewage lift stations and treatment plants (installation, expansion, and maintenance), including possible separation of combined storm/sanitary sewer systems, if appropriate.
- Purchase or transfer of development rights – to discourage development in floodplain areas.
- Stormwater management ordinances or amendments.
- Wetlands protection regulations and policies.
- Use of check valves, sump pumps and backflow preventers in homes and buildings.

Dam Failures

- Regular inspection and maintenance of dams.
- Garnering community support for a funding mechanism to assist dam owners in the removal or repair of dams in disrepair.
- Regulate development in the dam's hydraulic shadow (where flooding would occur if a severe dam failure occurred).
- Ensuring that dams meet or exceed the design criteria required by law.
- Public warning systems.
- Obtaining insurance.
- Increased coverage and use of NOAA Weather Radio
- Increased funding for dam inspections and enforcement of the Dam Safety Program (Part 315 of the Natural Resources and Environmental Protection Act) requirements and goals.
- Constructing emergency access roads to dams, where needed.
- Pump and flood gate installation/automation.

Drought

- Storage of water for use in drought events (especially for human needs during periods of extreme temperatures, and for responding to structural fire and wildfire events).
- Legislative acts, local ordinances, and other measures to prioritize or control water use.
- Encouragement of water-saving measures by consumers (including landscaping, irrigation, farming, and low-priority lawn maintenance and non-essential auto washing).
- Anticipation of potential drought conditions, and the preparation of drought contingency plans.
- Designs, for recreational and other water-related structures and land uses, that take into account the full range of water levels (of lakes, streams, and groundwater).
- Designs and plans for water delivery systems that include a consideration of drought events.
- Obtaining agricultural insurance.

C. ECOLOGICAL HAZARDS

Wildfires

- Proper maintenance of property in or near wildland areas (including short grass; thinned trees and removal of low-hanging branches; selection of fire-resistant vegetation; use of fire resistant roofing and building materials; use of functional shutters on windows; keeping flammables such as curtains securely away from windows or using heavy fire-resistant drapes; creating and maintaining a buffer zone (defensible space) between structures and adjacent wild lands; use of the fire department's home safety inspections; sweeping/cleaning dead or dry leaves, needles, twigs, and combustibles from roofs, decks, eaves, porches, and yards; keeping woodpiles and other combustibles

away from structures; use of boxed or enclosed eaves on houses; thorough cleaning-up of spilled flammable fluids; and keeping garage areas protected from blowing embers).
- Safe disposal of yard and house waste rather than through open burning.
- Use of fire spotters, towers, planes.
- Use of structural fire mitigation systems such as interior and exterior sprinklers, smoke detectors, and fire extinguishers.
- Arson prevention activities, including reduction of blight (cleaning up areas of abandoned or collapsed structures, accumulated junk or debris, and lands with a history of flammable substances stored, spilled, or dumped on them).
- Public notification of fire weather and fire warnings.
- Prescribed burns and fuel management (thinning of flammable vegetation, possibly including selective logging to thin out some areas. Fuels cleared can be given away as firewood or made into wood chips for distribution.)
- The creation of fuel breaks (areas where the spread of wildfires will be slowed or stopped due to removal of fuels, or the use of fire-retardant materials/vegetation) in high-risk forest or other areas.
- Keeping roads and driveways accessible to vehicles and fire equipment—driveways should be relatively straight and flat, with at least some open spaces to turn, bridges that can support emergency vehicles, and clearance wide and high enough for two-way traffic and emergency vehicle access (spare keys to gates for properties should be provided to the local fire department, and an address should be visible from the road so homes can be located quickly).
- Enclosing the foundations of homes and buildings rather than leaving them open with their underside exposed to blown embers or materials.
- Safe use and maintenance/cleaning of fireplaces and chimneys (with the use of spark arresters and emphasis on proper storage of flammable items). Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year.
- Proper maintenance and storage of motorized equipment that could catch on fire (from blown embers, etc.)
- Proper storage and use of flammables, including the use of flammable substances (such as when fueling machinery). Store gasoline, oily rags and other flammable materials in approved safety cans. Stack firewood at least 100 feet away and uphill from homes.
- Avoid building structures on hilltop locations, where they will be at greater risk from wildfires (in addition, hillsides facing south or west are more vulnerable to increased dryness and heat from sun exposure).
- Use of proper setbacks from slopes (outside of the "convection cone" of intense heat which would be projected up the slope of the hill as a wildfire "climbs" it).
- Have adequate water supplies for emergency fire fighting (in accordance with NFPA standards).
- Obtaining insurance.

Invasive Species
- Restrictions on the import and transport of species carriers.
- Adjustments to hunting, fishing, and other policies and regulations related to wildlife populations.
- Use of barriers to prevent invasive species travel.
- Use of competing species or other population control techniques.

D. GEOLOGICAL HAZARDS

Earthquakes – (the greatest Michigan threats would be to pipelines, buildings that are poorly designed or constructed, and the shelving, furniture, mirrors, gas cylinders, etc. within structures that could fall and cause injury or personal property damage)
- Adopt and enforce appropriate building codes.
- Use of safe interior designs and furniture arrangements.
- Obtain insurance.
- "Harden" critical infrastructure systems to meet seismic design standards for "lifelines."

Subsidence
- Identifying and mapping old mining areas and geologically unstable terrain, and limiting or preventing development in high-risk areas.
- Filling or buttressing subterranean open spaces (such as abandoned mines) to discourage their collapse.

- Hydrological monitoring of groundwater levels in subsidence-prone areas.
- Insurance coverage for subsidence hazards.
- Real estate disclosure laws.

Celestial Impacts

- Advance planning for catastrophic scenarios. For example, the U.S. Air Force used an asteroid strike for its December 2008 Interagency Deliberate Planning Exercise. The after-action report for that exercise was posted online at http://neo.jpl.nasa.gov/neo/Natural_Impact_After_Action_Report.pdf. An asteroid detected at a distance equivalent to that of the Earth's Moon could still give 8 hours of advance warning for the evacuation of coastal areas (to mitigate loss of life from a projected sea impact).
- Continued surveillance and analysis of Near-Earth Objects, and support for agencies that are engaged in such work. For example, since 1975, the Department of Defense has amassed extensive data about meteors entering the atmosphere, finding that hundreds per year explode in the atmosphere with explosive energy of at least 1 kiloton.
- Existing technologies would allow the diversion of a large asteroid or comet, if a sufficient lead time is available. Objects on a collision course 10 to 100 years in the future can be diverted or reduced by the use of conventional rockets and explosives. (Such action would be coordinated in the United States by the Departments of Defense and Energy, and would likely include international partners.) Explosives would require knowledge of an object's composition to be effective. Laser targeting could be used to change an object's velocity, although weeks or months may be required to obtain a large enough effect. With a sufficient amount of warning time (on the order of years), other mitigation techniques could include attaching a solar sail to the object, an interception/landing mission, and/or use of the "Yarkovsky effect" in which asteroid temperatures could be changed to affect its orbit.
- Various space missions have occurred to gather more information about asteroids and comets, and more are planned for the future. Some past missions have included Vega 1, Vega 2, Giotto, Suisei, and Sakigake (1986 flybys of Halley's Comet); Galileo (1995 observations of the Shoemaker-Levy comet impact); Near-Earth Asteroid Rendezvous (NEAR—asteroid investigations from 1997 to 2001); Deep Space 1 (comet rendezvous in 2001), Stardust (comet material collected and returned for analysis in 2006); Hayabusa (aka MUSES-C – asteroid landing and probing from 2005 to 2010); Rosetta (asteroid flybys from 2008 to 2010, and comet intercept mission scheduled for 2014-2015); and Deep Impact/EPOXI (comet rendezvous in 2005 and flyby in 2010). Additional missions can be expected to provide even more information.
- Awareness campaigns for industries and systems involving satellite communications, GPS, or radio communications that could be disrupted by solar flare (space weather) activity. In addition to the use of GPS for navigation, aviation, and military applications, it is also important for offshore drilling operations, precision farming, transportation, and mapping and surveying.
- Operating procedures that include back-up systems allowing complex systems (e.g. air traffic control) to continue to function when key technological systems (e.g. GPS, radio communications, satellites) malfunction. For example: the maintenance of "legacy" non-GPS navigational systems as a back-up, and the use of new GPS signals and codes to remove ranging errors.
- The use of special procedures, equipment, and redundancies by utility systems (e.g. electrical power and pipeline systems) to minimize the potential for geomagnetic effects to cause inappropriate shutdowns and system damage. For example: the provision of reserve capacity may offset the effects of geomagnetic storms, and the temporary disconnection of components for their own protection.
- Additional back-up satellites, for communications and navigation, will be needed to limit the damaging effects of a major solar storm, which may put current satellite equipment out of action and require their rapid replacements. The importance and cost of satellite systems may not be well-known to the general public. As of 2009, the existing fleet of 250 commercial satellites constituted a total investment of about $75 billion, and involved an annual revenue stream estimated at over $250 billion.

II. Technological Hazards

A. INDUSTRIAL HAZARDS

Structural Fires

- Code existence and enforcement.
- Designs that include the use of firewalls and sprinkler systems (especially in tall buildings, dormitories, attached structures, and special facilities).

- Landlords and families can install and maintain smoke detectors and fire extinguishers. Install a smoke alarm on each level of homes (to be tested monthly, with the batteries changed twice each year). Family members and residents should know how to use a fire extinguisher.
- Proper installation and maintenance of heating systems (especially those requiring regular cleaning, those using hand-loaded fuels such as wood, or using concentrated fuels such as liquid propane).
- Safe use and maintenance/cleaning of fireplaces and chimneys (with the use of spark arresters and proper storage of flammable items). Residents should inspect chimneys at least twice a year and clean them at least once a year.
- Safe installation, maintenance, and use of electrical outlets and wiring.
- Measures to reduce urban blight and associated arson (possibly including Crime Prevention through Environmental Design).
- Defensible space around structures in fire-prone wildland areas.
- Proper maintenance of power lines, and efficient response to fallen power lines.
- Transportation planning that provides roads, overpasses, etc. to maximize access and improve emergency response times to all inhabited or developed areas of a community. (Not just planning for average traffic volumes in the community.)
- Discourage civil disturbances and criminal activities that could lead to arson.
- Enforced fireworks regulations.
- Elimination of clandestine methamphetamine laboratories through law enforcement and public education.
- Condominium-type associations for maintaining safety in attached housing/building units or multi-unit structures.
- Obtaining insurance.

Scrap Tire Fires

- Policies for regulated disposal and management of scrap tires, and enforcement of regulations related to them (separation of stored scrap tires from other materials; limits on the size of each pile; minimum distances between piles and property lines; covering, chemically treating, or shredding tires to limit mosquito breeding; providing for fire vehicle access to scrap tire piles; training employees in emergency response operations; installation of earthen berms around storage areas; prevention of pools of standing water in the area; control of nearby vegetation; an emergency plan posted on the property; storing only the permitted volume of tires authorized for that site).
- Proper siting of tire storage and processing facilities (land use planning that recognizes scrap tire sites as a real hazard and environmental threat).
- Pest-control measures for mosquitoes and other nuisances around scrap tire yards.

Fixed Site Hazardous Material Incidents (including explosions and industrial accidents)

- Compliance with/enforcement of Resource Conservation and Recovery Act (RCRA) standards.
- Elimination of clandestine methamphetamine laboratories through law enforcement and public education.
- Identification of radioactive soils and high-radon areas
- Proper separation and buffering between industrial areas and other land uses.
- Location of industrial areas away from schools, nursing homes, etc.
- Public warning systems and networks for hazardous material releases.
- Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including large scale hazardous material incidents).
- Compliance with all industrial, fire, and safety regulations.
- Insurance coverage.
- Enhanced security and anti-terrorist/sabotage/civil disturbance measures.

Hazardous Material Transportation Incidents

- Improved design, routing, and traffic control at problem roadway areas.
- Long-term planning that provides more connector roads for reduced congestion of arterial roads.
- Railroad inspections, maintenance and improved designs at problem railway/roadway intersections (at grade crossings, rural signs/signals for RR crossing).
- Proper planning, design, maintenance of, and enhancements to designated truck routes.
- Public warning systems and networks.

- Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including large scale hazardous material incidents).
- Use of ITS (intelligent transportation systems) technology.
- Locating schools, nursing homes, and other special facilities away from major hazardous material transportation routes.

Pipeline Accidents (Petroleum and Natural Gas)
- Locating pipelines away from dense development, critical facilities, special needs populations, and environmentally vulnerable areas whenever possible.
- Increasing public awareness and widespread use of the "MISS DIG" utility damage prevention service (800-482-7171).
- Proper pipeline design, construction, maintenance and inspection.

Nuclear Power Plant Emergencies
- Arrangements for designated shelters and accident warning systems.
- Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including plant accidents).

Oil and Natural Gas Well Accidents
- Using buffer strips to segregate wells, storage tanks, and other production facilities from transportation routes and adjacent land uses, in accordance with state regulations, and consistent with the level of risk.
- Adherence to all regulations and best industry practices, especially for relatively new techniques of hydraulic fracturing, in order to preserve Michigan's environmental quality and public confidence in the industry.

B. INFRASTRUCTURE HAZARDS

Infrastructure Failures
- Proper location, design, and maintenance of water and sewer systems (to include insulation of critical components to prevent damage from ground freeze).
- Burying electrical and phone lines, where beneficial and appropriate, to resist damage from severe winds, lightning, ice, and other hazards.
- Redundancies in utility and communications systems, especially "lifeline" systems; to increase resilience (even if at the cost of some efficiency).
- Separation and/or expansion of sewer system to handle anticipated stormwater volumes.
- Use of generators for backup power at critical facilities.
- "Rolling blackouts" in electrical systems that will otherwise fail completely due to overloading.
- Replacement or renovation of aging structures and equipment (to be made as hazard-resistant as economically possible).
- Physical protection of electrical and communications systems from lightning strikes.
- Tree-trimming programs to protect utility wires from falling branches. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
- Increasing public awareness and widespread use of the "MISS DIG" utility damage prevention service (800-482-7171).

Energy Emergencies
- Redundancies and alternatives in the energy supply system; provision of backup supply systems.
- The capacity to use more than one type of fuel to sustain necessary operations and functions.
- Use of alternative sources of energy (e.g. solar, wind sources) for key functions.
- Architectural designs that reduce the need for outside energy inputs.

Transportation Accidents
- Improved design, routing, and traffic control at problem roadway areas.
- Railroad inspections and improved designs at problem railway/roadway intersections (at grade crossings, rural signs/signals for RR crossing).

- Long-term planning that provides more connector roads for reduced congestion of arterial roads.
- Use of designated truck routes.
- Use of ITS (intelligent transportation systems) technology.
- Airport maintenance, security, and safety programs.

III. Human-Related Hazards

Civil Disturbances (prison or institutional rebellions, disruptive political gatherings, violent labor disputes, urban protests or riots, or large-scale uncontrolled festivities)

- Some suggest that design, management, integration, and lowered density of poor or blighted areas will reduce vandalism, crime, and some types of riot events. Crime Prevention Through Environmental Design (CPTED) is a field of planning that deals with this.
- Structure and property insurance in risky areas, combined with anti-arson practices.
- Design requirements for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, etc. that take into consideration emergency and security needs.

Nuclear Attack

- Designated fallout shelters and public warning systems.
- Construction of concrete safe rooms (or shelters) in houses, trailer parks, community facilities, and business districts.
- Using laminated glass, metal shutters, structural bracing, and other hazard-resistant, durable construction techniques in public buildings and critical facilities.
- Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including enemy attack).

Public Health Emergencies

- Immunization programs to vaccinate against communicable diseases.
- Improving ventilation techniques in areas, facilities, or vehicles that are prone to crowding, or that may involve exposure to contagion or noxious atmospheres.
- Radon detection and abatement activities, to reduce concentrations of radon in homes and buildings.
- Maintaining community water and sewer infrastructure at acceptable operating standards.
- Providing back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
- Demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Free or reduced-expense community clinics and school health services.
- Brownfield and urban blight clean-up activities.
- Proper location, installation, cleaning, monitoring, and maintenance of septic tanks.
- Separation of storm and sanitary sewer systems.

Terrorism and Similar Criminal Activities

- Using laminated glass and other hazard-resistant, durable construction techniques in public buildings and critical facilities.
- Establishing avenues of reporting (and rewards) for information preventing terrorist incidents and sabotage.
- Consistent use of computer data back-up systems and anti-virus software.

- **SPECIAL SECTION: Consequence Analysis – Impact on Public Confidence in State Governance**

In late 2009 and early 2010, in order to meet additional planning requirements of the Emergency Management Accreditation Program (EMAP), contacts were made with representatives of the following agencies, who were considered to be potentially knowledgeable authorities on the subject of evaluating public confidence in governance:

Disaster Research Center (University of Delaware)
Institute for Public Policy and Social Research (Michigan State University)
National Opinion Research Center
Public Sector Consultants (Lansing, MI)
The Rand Corporation

Especially helpful was a discussion with Dr. Joe Trainor, of the Disaster Research Center. He reported that public confidence in government is rooted in the public's expectations of its government, and that this varies by community. (For example, more conservative political jurisdictions tend to have a greater sense of local independence, and correspondingly lessened expectations in State government.) There is an ongoing need to synchronize planning objectives with community expectations (especially in recovery operations, but also in response). This procedure typically involves the encouragement of consensus among stakeholders who disagree.

Since public expectations vary by community, information was sought concerning the variables that correlate with such expectations, and thus would also be expected to correlate with public confidence, and thus suggest something about how various hazards may affect such confidence. Andrew Morral, of the Rand Corporation, pointed out that negative impacts on public confidence in governance typically stem from gaps in response capabilities (as in the case of Hurricane Katrina).

Actual survey information is available for the State of Michigan, and its numerous regions. The Institute for Public Policy and Social Research, located at Michigan State University, conducts a "State of the State" survey (SOSS) four times per year. These scientific surveys include ongoing "tracking" questions that are asked regularly, as well as many specialized one-time questions designed to assess specific topics of current interest. Among the longitudinal questions (which can be assessed for change over time) are several that pertain to public confidence in government. The survey regularly asks separate questions about each level of government (local, state, and federal), and allows the responses to be analyzed for correlations and trends among 7 pre-defined survey regions as well as by the type of community that respondents live in (rural, small town, suburb, major city).

Longitudinal data was found for a 15-year period that included all SOSS surveys performed during the (full) years from 1994 to 2008. The overall survey has a reported margin of error of 3.1% (although error is larger for various individual cells within the tables used in this Plan Annex). Regional sampling data for each region were weighted to produce statewide figures. The various survey rounds each tended to cover a sample of between about 950 and 1450 Michigan adults. Additional information about the SOSS can be found at http://www.ippsr.msu.edu/SOSS . **The interpretations, analysis, and conclusions drawn from this survey data in this planning annex are solely those of MSP/EMHSD staff, and do not necessarily represent the ideas, views, or conclusions of Michigan State University or of IPPSR or its staff.** For the 2014 update of the MHMP, it was noticed that the same resources that had been accessed in 2010 were no longer readily available online. These would have been useful to simply replace previous tables and extend graph lines in this section of the MHMP, but instead, new information was able to be obtained in a matter that is described with new text and separate tables. Most of this new information supplements that which was obtained three years earlier, rather than replaces it. It is useful to compare trends in this kind of opinion data by viewing the most recent information in comparison with that from previous years.

In general, the public has more trust in government at the local and state level, and less trust in the federal level of government. The latest SOSS data (2012) on key questions regarding emergency management and trust in public governance reports that about 32% of Michigan respondents expressed the sentiment that the federal government can be trusted "seldom" or "almost never." Only about 22% expressed such an attitude about State government, and 19% about local governments. The survey used separate questions that distinguished between general trust in government and the respondents' assessment of specific public figures, such as the president and governor.

In 2010 longitudinal data, it was found that trust in state government was significantly lower in Detroit, where 31% expressed mistrust, compared to only 19% statewide at that time. The table on the next page shows the results obtained from the survey item which asked respondents, "How much of the time do you think you can trust the state government in Lansing to do what is right – nearly always or most of the time, some of the time, seldom, or almost never." Responses are presented in each row of the table, with separate columns (labeled along the top) that show how the answers varied across each of the seven survey regions of the state.

In addition to the lower trust expressed in the City of Detroit, the other statistically significant pattern found in the 2010 longitudinal table pertains to two other broad areas of the state: (1) the Upper Peninsula, and (2) the areas of the central and southern Lower Peninsula that are outside of the Metro-Detroit Regions. These areas were slightly more likely (a difference of only a few percentage points) to express a high level of trust in state government. Please note that this area does not include the northern Lower Peninsula region, which for survey purposes was considered to be composed of the 20 counties that are east and northeast of (but not including) Manistee County.

The SOSS analysis tables reprinted here are color-coded so that the most significant cell values are given darker shadings, and denote statistically significant correlations (either positive or negative). The standard used here for statistical significance is a Z-statistic that is greater than 2.0, which means that there is just over a 95% chance that the value in question does indeed vary significantly from the population as a whole (i.e. that it is "statistically significant"), rather than effectively being considered as approximately the same.

For readers who are not well-versed in statistical theory, it should be noted that statistical significance expresses a degree of reliability in measured survey data but not necessarily the strength, magnitude, or importance of the observed relationship. In other words, a high z score shows the extent of our confidence in the measurement, but the measurement itself may show only a very small demonstrated relationship between two variables. (For example, although we can state with certainty that a 1% income tax will lower a person's net income when it's deducted from a paycheck, this demonstrated relationship between that level of taxation and income may be small enough that many people might consider it to be of little concern, while for others it may be of enormous concern. Statistical significance means an estimate of the certainty that a relationship exists between measured variables, not the extent or importance of any such relationship, which is measured according to the extent of change seen in one variable as a result of some change in another.)

In addition, new information for 2012 has been found and included in the table on this page.

2012 SOSS Information about trust in different levels of government			
Trust in:	Federal government	State government	Local government
Nearly all/most of the time	19.5%	25.3%	39.5%
Some of the time	48.1%	52.4%	41.6%
Seldom	21.8%	15.5%	11.6%
Never	10.6%	6.8%	7.3%

How Often Trust State Government - Frequency Distribution, 1994-2008 Longitudinal Data File								
Cells contain: -Column percent -Z-statistic -N of cases	Source: MSU IPPSR SOSS (online data analysis run Feb. 2010)							
	1 Upper Peninsula	2 Northern Lower Peninsula	3 West Central L.P.	4 East Central L.P.	5 Southwest L.P.	6 Southeast L.P. (- Detroit)	7 Detroit	***ROW TOTAL***
1: NEARLY ALL OR MOST OF THE TIME	**32.5** 2.20 160	**27.2** -.58 207	**31.9** 4.09 652	**32.2** 3.39 403	**31.3** 3.39 634	**26.8** -3.15 1,782	**19.1** -7.73 258	***28.1*** --- *4,095*
2: SOME OF THE TIME	**49.1** -1.58 242	**50.7** -1.08 387	**51.7** -.86 1,058	**52.6** -.02 657	**51.9** -.70 1,053	**54.2** 3.40 3,596	**49.9** -2.13 673	***52.6*** --- *7,665*
3: SELDOM	**13.2** -.05 65	**15.6** 1.97 119	**11.4** -2.64 233	**10.8** -2.69 134	**11.6** -2.40 235	**13.2** .03 880	**19.5** 7.09 263	***13.2*** --- *1,928*
4: NEVER	**5.2** -.77 26	**6.5** .56 50	**5.0** -2.16 101	**4.4** -2.53 55	**5.3** -1.51 107	**5.8** -1.23 382	**11.6** 8.99 156	***6.0*** --- *876*
COL TOTAL	***100.0*** --- *492*	***100.0*** --- *763*	***100.0*** --- *2,045*	***100.0*** --- *1,248*	***100.0*** --- *2,029*	***100.0*** --- *6,639*	***100.0*** --- *1,349*	***100.0*** --- *14,565*
Means	1.91	2.01	1.89	1.87	1.91	1.98	2.24	1.97
Std Devs	.81	.83	.79	.77	.79	.79	.89	.81
Unweighted N	898	1,263	2,971	2,193	2,325	2,752	2,136	14,538

Color coding:	<-2.0	<-1.0	<0.0	>0.0	>1.0	>2.0	**Z**
N in each cell:	Smaller than expected			Larger than expected			

Expressed trust in state government was also analyzed with respect to the type of community in which respondents lived. The results of this analysis, for 2010 longitudinal data, appear in the table on the following page. Although higher levels of distrust were expressed within urban areas, collectively, this is actually explained by the inclusion of the City of Detroit within the "Urban Community" category, for when the data are further broken down while controlling for community type, respondents in urban communities in all other regions outside of Detroit expressed below-average levels of distrust. Since 41% of all "Urban Community" respondents were from Detroit, the greater proportion of dissatisfaction among Detroit responses pulled down the numbers for urban residents as a category. It should be kept in mind, however, that far fewer than half of all respondents, in any combination of these categories, stated that they seldom or almost never trusted state government. The analysis merely identifies varying proportions of distrust between state regions.

These types of analytic breakdowns of the level of trust by community and region were not conveniently available for use in the data available to update this plan in 2014. Later inquiry with IPPSR may be needed to provide that level of detail for later updates of this analysis, but these specific issues are already a bit abstracted from the main question of how emergency management or disasters might affect public confidence in governance. The attempt to establish some plausible reason to account for trends in trust or mistrust (the closest survey information available to express "confidence") will be addressed in subsequent pages in this section.

How Often Trust State Government - Frequency Distribution, 1994-2008 Longitudinal Data File						
Cells contain: -Column percent -Z-statistic -N of cases	Source: MSU IPPSR SOSS (online data analysis run Feb. 2010)					
	1 RURAL COMMUNITY	2 SMALL CITY OR TOWN, VILLAGE	3 A SUBURB	4 URBAN COMMUNITY	7 OTHER	***ROW TOTAL***
1: NEARLY ALL OR MOST OF THE TIME	**28.8** 2.04 953	**28.4** 1.60 1,193	**26.3** -1.64 807	**25.7** -1.89 471	**17.6** -2.65 25	***27.5*** --- *3,449*
2: SOME OF THE TIME	**52.5** -.47 1,736	**50.5** -3.80 2,121	**57.6** 6.08 1,766	**50.6** -2.06 929	**57.3** 1.08 83	***52.8*** --- *6,634*
3: SELDOM	**13.7** .31 454	**14.1** 1.20 592	**11.7** -3.38 360	**14.7** 1.55 270	**18.9** 1.89 27	***13.6*** --- *1,702*
4: NEVER	**4.9** -3.26 164	**7.1** 3.22 298	**4.3** -4.79 132	**9.0** 5.59 165	**6.1** -.01 9	***6.1*** --- *768*
COL TOTAL	***100.0*** --- *3,306*	***100.0*** --- *4,203*	***100.0*** --- *3,065*	***100.0*** --- *1,834*	***100.0*** --- *144*	***100.0*** --- *12,553*
Means	1.95	2.00	1.94	2.07	2.13	1.98
Std Devs	.79	.84	.74	.87	.77	.81
Unweighted N	3,703	4,300	2,191	2,168	140	12,502

Color coding:	<-2.0	<-1.0	<0.0	>0.0	>1.0	>2.0	**Z**
N in each cell:	Smaller than expected			Larger than expected			

What might be some reasons for distrust in government, where it exists? Perhaps some clues can be found in the survey questions that ask respondents about the "most important problem" facing their local community, the most important problem for the State governor and legislature, and the "overall quality of life" in their community. As the table on the following page shows, Detroit also stands out as being more frequently assessed as having "fair" or "poor" overall quality of life. The only other areas with (statistically significant) critical or ambivalent opinions on this topic were small cities/towns in the nearby Metro area (who had a slightly higher proportion, 7%, responding "poor"), and suburban respondents in the East Lower Peninsula region (who had a relatively high percentage, 42%, responding "fair"). Please note that these types of more detailed multivariate analysis have not been included in this document, which only includes a few of the most relevant two-variable cross tables obtained from this information source in 2010 (supplemented where possible with readily available 2012 survey information).

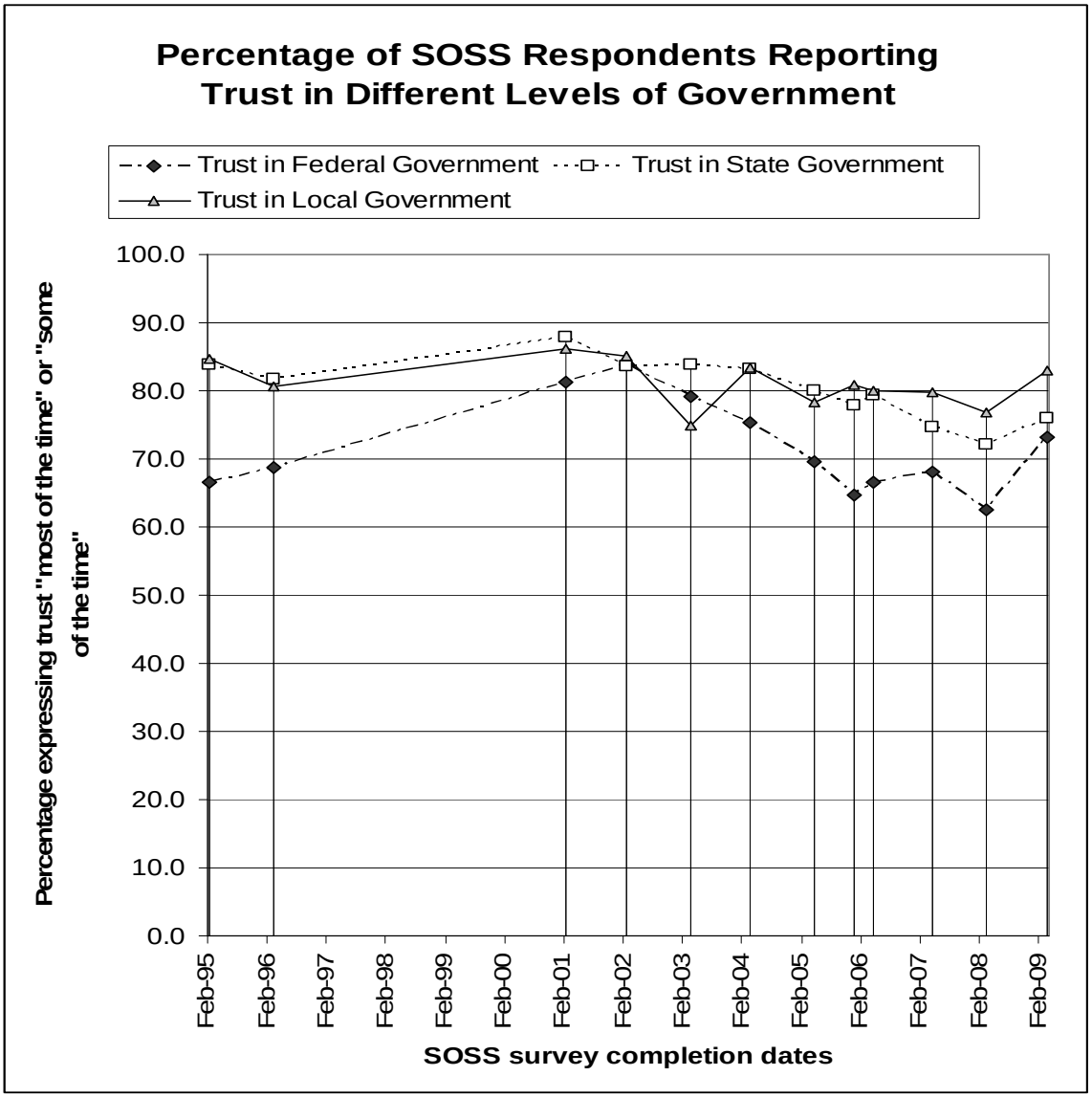
NOTE: 2012 survey results for the quality of life question were readily available for the total column only (in the far right side of the following table) and were found to be unchanged from the 2010 longitudinal results.

Overall Quality of Life In Community - Frequency Distribution, 1994-2008 Longitudinal Data File								
Cells contain: -Column percent -Z-statistic -N of cases	Source: MSU IPPSR SOSS (online data analysis run Feb. 2010)							
	1 Upper Peninsula	2 Northern Lower Peninsula	3 West Central L.P.	4 East Central L.P.	5 Southwest L.P.	6 Southeast L.P. (-Detroit)	7 Detroit	***ROW TOTAL***
1: EXCELLENT	**17.8** -.06 30	**22.1** 1.76 56	**19.5** 1.13 133	**19.8** 1.05 84	**13.0** -3.60 89	**20.6** 4.40 461	**6.3** -6.86 30	***17.9*** --- *883*
2: GOOD	**57.4** .30 96	**53.1** -1.02 135	**59.3** 1.75 405	**55.4** -.35 236	**63.0** 3.83 431	**59.0** 3.57 1,322	**30.6** -11.75 143	***56.2*** --- *2,769*
3: FAIR	**23.0** .36 39	**20.1** -.69 51	**18.7** -2.20 128	**22.7** .43 97	**21.6** -.22 148	**17.1** -7.48 382	**50.0** 15.46 233	***21.9*** --- *1,078*
4: POOR	**1.8** -1.43 3	**4.7** .60 12	**2.6** -2.02 18	**2.1** -2.10 9	**2.4** -2.20 17	**3.4** -1.88 76	**13.1** 10.62 61	***4.0*** --- *195*
COL TOTAL	***100.0*** --- *168*	***100.0*** --- *254*	***100.0*** --- *684*	***100.0*** --- *426*	***100.0*** --- *685*	***100.0*** --- *2,241*	***100.0*** --- *467*	***100.0*** --- *4,925*
Means	2.09	2.07	2.04	2.07	2.13	2.03	2.70	2.12
Std Devs	.69	.78	.69	.71	.65	.71	.77	.74
Unweighted N	314	394	1,013	747	789	925	745	4,927

Color coding:	<-2.0	<-1.0	<0.0	>0.0	>1.0	>2.0	**Z**
N in each cell:	Smaller than expected			Larger than expected			

Assessing levels of government trust over time may provide some additional insight on possible connections between hazards, vulnerabilities, and public confidence. We might expect that variations in public trust would occur after major disaster or emergency events, if such conditions really do have a major impact on public trust in government. The graph on the following page shows how public trust in three levels of government have varied over time, as assessed by SOSS surveys. Most of the time, there was a lower level of trust in federal government than there was in state or local government, but in survey responses following the events of 9-11-2001, trust in federal government was at a peak, equivalent to the other two levels of government, before dropping down again. A lower point followed the Hurricane Katrina and Rita events. These trends may be purely circumstantial, however, and not actually have been caused by those events—more scrutiny of the data would be necessary to try to draw any specific conclusions of that type. But it may be possible to use this survey data and analyze it to see whether certain types of local or state disaster events were followed by a drop in public trust. In the current assessment, the concerns identified by respondents will be focused upon.

NOTE: As shown in a preceding table, new 2012 data was found for this information, and these latest numbers show a 67.6% level of trust in federal government, 77.7% trust in state government, and 81.1% trust in local government. This information extends the data already presented in the 2010 graph on the next page.



Updated 2012 SOSS data were also obtained about the types of issues respondents felt were the most significant problems that needed to be addressed, and these have been compared with the information that was available in 2010 (actually surveyed in 2008) for the previous edition of this plan. Community problems most commonly identified by respondents (statewide) included:

2012	2008	
32.8%	20.8%	Unemployment/jobs/young people lack good jobs
12.9%	17.2%	Crime, drugs, gangs, teen violence, safety, street violence, theft (Respondents in the City of Detroit were more likely to select these problems, except for the "gang" and "teen violence" phrasing, which was more often reported by respondents in the broader Metro area.)
8.8%	10.2%	School finance/quality, education funding, similar education topics
9.2%	8.4%	Development, growth, economy, loss of businesses
4.9%	5.8%	Miscellaneous other problems
3.4%	4.5%	Roads: need repair, street upkeep
3.0%	4.2%	No problems
2.4%	3.3%	Overexpansion/growth, population growth, land use, preservation of wetland and natural areas
3.3%	3.2%	Taxes, city taxes, city finances, city commissioners

Most identified problems have declined over the past few years, replaced with a huge jump in the unemployment problem.

Some of these topics, such as crime, roads, and land use and environment, have relevance to Michigan hazard mitigation topics. Some less-frequently selected topics that also have relevance to hazard mitigation include:

2012	2008	
1.5%	2.1%	Water/sewer, trash collection, police/fire services
1.2%	1.7%	Traffic, transportation, buses, etc., other public services
1.1%	1.6%	Pollution, dirty city appearance, junk lying around, other environmental

When asked to identify the most important problem for the State Governor and legislature, respondents most frequently selected the following:

2012	2008	
26.6%	17.7%	Jobs, unemployment, employment, more work, etc.
18.6%	22.9%	Education, schools, school financing & funding
13.0%	12.4%	The economy, business in state, encourage business growth
6.2%	6.9%	Health care, medical care, mental health, etc.
5.1%	6.6%	Crime, safety, drugs, violence, law & order, prisons
4.5%	5.4%	Taxes, property taxes, etc.
4.6%	5.1%	(Miscellaneous)

In addition to crime & safety, some of the less frequently selected topics that are of relevance to hazard mitigation planning include:

2012	2008	
2.6%	3.2%	Roads, highways, bridges (repairs, maintenance)
2.2%	2.6%	Environment, clean-up, pollution control, etc.
0.5%	0.6%	Foreign policy, world affairs, defense (Note: Responsibility for these affairs is usually assigned to federal government.)
0.1%	0.1%	Infrastructure of cities

It must be noted that the recent winter weather of 2013-2014 has caused a rapid breakdown of roadway quality across the state. It is safe to say that the survey information in this section does not reflect the true current concern with the widespread poor condition of local surface streets, roads, and highways.

Books and documents recommended by Joe Trainor (of the Disaster Research Center) had produced the following additional information. A chapter in the Handbook of Disaster Research stated that the public envisions disaster recovery in terms of a return to "normalcy," while administrators, planners, and other experts instead wish to emphasize changes, which include improvements and hazard mitigation. A "sustainable development" approach to disaster recovery thus requires public involvement, effective pre-disaster planning, and a focus on equity. Recovery activities should meet local needs, match local capabilities, and, where possible, be rooted in effective recovery plans.

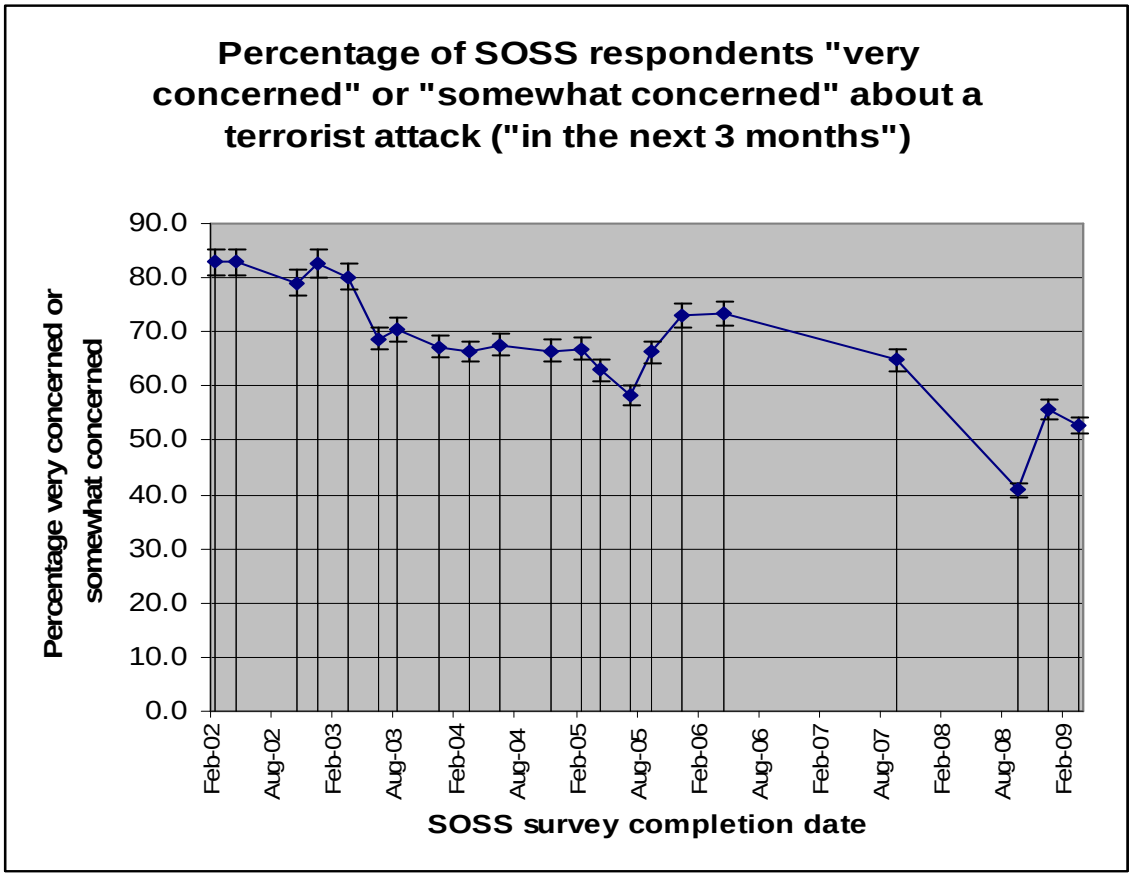
In the light of all this information, it does not appear that disasters have played much role in shaping residents' trust in Michigan government, although national circumstances (e.g. Hurricane Katrina) have suggested that it is indeed possible for such events to have a significant influence. Economic and political problems seem to be more directly connected with public confidence in government, and even though disasters can have economic impacts, Michigan's vulnerability has been rather limited, and the trends seen in the most recent survey data about these matters suggest a relative reduction in the amount of concern, in the face of economic/employment issues. One of the survey questions (Winter 1995) asked respondents whether the most important problem they had identified is something that should be addressed by government, by voluntary/community organizations, by business, or by people themselves. About 34% said government should address the problem. Although this was the most common of all the answers, as categorized (followed by "people themselves," with 32%), it needs to be noted that the idea was still expressed by a minority of respondents. The majority felt that non-governmental solutions were better, or that a combination of multiple entities should work together.

Issues such as crime and the environment were highlighted in the various editions of SOSS, but since only certain types of crime and environmental issues are potential disaster situations, most of the details of those surveys will not

be addressed here. However, in the Winter 1996 survey, 51% of respondents felt that the government was doing too little to protect the environment (while 38% felt it was doing about the right amount). About 57% felt it was very important to have environmental information, but 47% felt that it was somewhat difficult or very difficult to obtain accurate information about the subject. Although questions on this topic were not repeated in any later survey, it may be assumed that the availability of information on this topic has increased greatly since the rise of the internet (which was at the time being cited as a main source of information by fewer than 1% of respondents).

One of the specific hazards that was tracked by the SOSS surveys was the issue of terrorism and nuclear attack. In the Spring of 1999, when respondents were asked how much the development of atomic weapons in Pakistan and India may affect the well-being of persons in the United States, 58% responded "a great deal" and 30% responded "somewhat." When respondents were asked about the extent of American interests in the Middle East, 59% stated that these interests were "very significant," and 35% said "somewhat significant."

After the events of 9-11-2001, many additional questions were asked to gauge public opinion and attitudes toward various aspects of terrorist threats and activities. One of the questions included regularly in the survey each year asks respondents to express how much concern they have about another terrorist attack, and the likelihood that such an attack may affect Michigan or some other location in the United States. Overall (across all SOSS surveys), about 20 percent of respondents said that they were "very concerned" that "the United States might suffer another terrorist attack in the next 3 months," and another 43 percent said that they were "somewhat concerned." The level of concern has varied over time, as shown in the graph below, which shows the percentage of SOSS respondents who were either "very concerned" or "somewhat concerned" about a terrorist attack "in the next 3 months" following their dates of response. New 2012 data shows that this percentage has increased a bit from the 2009 figure shown in the table, at 61.7%. Given that the attempted airliner bombing as it flew near and over Detroit had taken place in Michigan at the end of 2009, this increased level of concern is not at all surprising. Recent state and national events involving shootings (near I-96, Sandy Hill Elementary) and bombings (e.g. Boston Marathon) can be expected to increase concern still further within the past couple of years since the 2012 data were collected.



A 3% margin of error is marked for each data point on the graph. Data points that appear within the range marked by these lines cannot with much confidence be considered to differ significantly from each other. It can easily be seen that concern was much higher during the period immediately following the events of 9-11-2001 (and subsequent anthrax scares). By mid-2003, however, a lower degree of concern had become evident but remained quite stable for a couple of years. A minor dip is suggested by the mid-2005 survey results, but levels of concern were a bit higher by 2006. Concern was substantially lower again by mid-2008 but did not seem particularly stable in recent years, based on the most recent survey results.

It seems reasonable that concern would decline over time if there are no significant events that remind people of a threat or vulnerability, and that may be the case here. The rise in concern after mid-2005 may have been caused by the July 7, 2005 London subway and bus bombings. The years 2005 and 2006 also marked a peak in terrorist casualties in Iraq, which were given a great deal of media attention and, despite their geographic remoteness from U.S. domestic security affairs, may have reminded the public of the terrorist threat. The lower concern expressed in 2008 may have subsequently been elevated by the Mumbai hotel attacks of November 8, reflected in the subsequent survey results.

This discussion brings back the question of what effect these types of hazards may have had on the public's trust in government. One question that was asked repeatedly involved the amount of responsibility that the United States bears "for the hatred that led to the 9/11 terrorist attacks." Overall (not breaking the results down by year, but according to 2010 the longitudinal search), 59.4 percent of respondents expressed the opinion that the United States either bears "a lot" of responsibility, or "some" responsibility, while 40.5 percent stated that the United States bears only "a little" responsibility, or "none at all" for the events that occurred that day.

Despite this, when respondents were specifically asked, in early 2002, to "rate the job the U.S. government is doing defending Americans at home from future terrorist attacks," 76.1 percent responded with either "excellent" or "good." (21.4% said "fair" and only 2.5% said poor.) Respondents were similarly asked to assess the job that the State of Michigan was doing, and 62.9 percent said either "excellent" or "good" (with only 6.7% saying "poor). In 2005, the assessment had fallen, with 50.8% of respondents saying "excellent" or "good."

Another 2002 survey asked respondents how much confidence they had in "the ability of the U.S. government to prevent further terrorist attacks against Americans in this country," and 58.4% of respondents said either "a great deal" or "a good amount" of confidence. (35.5% said "only a fair amount," while only 6.1% said "none at all.") Survey results on these questions obtained later in 2002 showed a slight decrease (54.1%) in such confidence. A re-worded 2004 question asking how well the federal government has prevented or prepared "for the possibility of another terrorist attack" resulted in 53.6% responding "excellent" or "good" and 16% saying "poor," and a similar 2005 question resulted in only 48.6% of respondents selecting "excellent" or "good."

In 2002, respondents were also asked how well prepared they think that their state and local governments are for a potential terrorist attack in Michigan. "Very prepared" was reported by only 8.6%, but 67% said "somewhat prepared," and only 5.9% said "not prepared at all." When asked specifically about state and local preparedness for a potential bio-terrorist attack, the results were slightly less confident (6.5% "very prepared," 60.6% "somewhat prepared," 22.4% "not very prepared," and 10.6% "not prepared at all.") Most respondents felt that neighborhood watch groups and utility service workers (meter readers, repairmen, etc.) should play some role in helping to identify potential terrorists. Most respondents also felt there was a role to be played by "special citizen patrols created solely for the purpose of looking for suspicious activity" in the neighborhood.

Follow-up questions in 2004 revealed that 51.1% of respondents felt that the ability of terrorists "to launch another major attack on the U.S." had lessened over the previous year (while 15.9% thought it had strengthened and 33% felt it was about the same). Most respondents in 2005 felt that Detroit was a less likely target for terrorism than Los Angeles, but 20.5% felt that it was "very likely" or "somewhat likely" that a terrorist attack would occur somewhere in the state over the following year. When the same respondents were asked to estimate the likelihood of a terrorist attack somewhere in the United States during the following year, 69.2% said "very likely" or "somewhat likely." Most respondents felt that terrorists preferred high-profile targets rather than random targets that would merely promote a sense of chaos and fear. Respondents preferred (80% versus 20%) that anti-terrorist funding be distributed based upon the geography of higher-profile targets, rather than assigned equally to each of Michigan's counties.

In advance of the following large section that gives a full analysis of Michigan's hazards, this short subsection provides definitions for various terms that will be relevant throughout this plan.

Selected Hazard Mitigation Definitions

ACQUISITION/RELOCATION: A voluntary program offered through the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), Pre-Disaster Mitigation Program (PDMP), Repetitive Flood Claims Program (RFCP), and Severe Repetitive Loss Program (SRLP) where repetitively flooded structures may be acquired by a municipality in order to remove the structure from the floodplain. The property owner is given pre-flood fair market value for the property. The municipality then clears the property of the structure and maintains the property as open space in perpetuity. The State is the administrator of the grant throughout this process and monitors the municipality in maintaining this property as open space.

ASSISTANCE: Any form of federal grant to implement cost-effective mitigation measures that will reduce the risk of future damage, hardship, loss, or suffering as a result of major disasters.

BASE FLOOD: That flood having a one percent chance of being equaled or exceeded in any given year. Commonly called the "100-year" flood.

COMMUNITY: Any state or area or political subdivision thereof, or any Indian Tribe or authorized tribal organization, or Alaska Native Village or authorized native organization which has authority to adopt and enforce floodplain management regulations for the areas within its jurisdiction.

COUNTY OR LOCAL EMERGENCY MANAGEMENT COORDINATOR: A person appointed pursuant to Act 390, P.A. 1976, as amended, to coordinate emergency management activities for a county or municipal emergency management program. Also commonly called County or Local "Emergency Manager."

DAMAGE ASSESSMENT: The systematic process of determining and appraising the nature and extent of the loss, suffering, or harm to a community resulting from an emergency/disaster.

DISASTER FIELD OFFICE (DFO): The location established within the disaster area that functions as the joint federal-state center for all response and recovery activities.

DISASTER MITIGATION ACT (DMA) OF 2000: Public Law 106-390, signed into law on October 30, 2000, which amended sections of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) and placed new hazard mitigation planning requirements on states and local governments in order to obtain Stafford Act disaster relief assistance.

DISASTER RECOVERY CENTER (DRC): A location established within the disaster area that functions as a "one-stop" information source for disaster recovery and hazard mitigation-related issues. DRCs are staffed by personnel from FEMA and other Federal agencies, state and local agencies, and private, voluntary relief organizations.

DISTRICT COORDINATOR: The Michigan State Police Emergency Management and Homeland Security Division employee serving at any of eight State Police District Headquarters, whose primary job is to work directly with local communities on emergency management activities.

DRY FLOODPROOFING: Any combination of adjustments and/or additions to structures that are intended to eliminate or reduce the potential for flood damage by preventing water from entering the structure. (Examples: waterproof walls and floors; permanently or contingently seal doors, windows, or other openings; build a berm higher than the floor level.)

ELEVATION: A voluntary program offered through the HMGP, FMAP PDMP, RFCP, and SRLP to raise the first floor of a structure at least one-foot above the recorded base flood ("100-year") elevation. Utilities can also be raised to reduce damage to structures.

EMERGENCY MANAGEMENT AND HOMELAND SECURITY DIVISION (MSP/EMHSD): The division within the Department of State Police that coordinates the comprehensive emergency management activities (mitigation, preparedness, response and recovery) and homeland security activities of state and local government and maintains the Michigan Emergency Management Plan and Michigan Hazard Mitigation Plan. The Emergency Management and Homeland Security Division is also the primary state coordinating agency for the HMGP, FMAP, PDMP, RFCP, and SRLP, and serves as the administrative arm of the Michigan Citizen-Community Emergency Response Coordinating Council (MCCERCC).

ENVIRONMENTAL ASSESSMENT: A document that is prepared when an HMGP, FMAP, PDMP, RFCP, or SRLP project does not qualify as a categorical exclusion and serves to determine whether an Environmental Impact Statement is needed.

ENVIRONMENTAL IMPACT STATEMENT: A document that is prepared for all actions significantly affecting the environment.

EXECUTIVE ORDER 1977-4: A Michigan Executive Order issued by Governor William G. Milliken on May 13, 1977 that 1) designated an administering state agency for the state flood hazard management program, 2) directed state agency directors to prevent uneconomic uses and the development of the State's floodplains, and 3) directed state agency directors to reduce the risk of flood losses in connection with state lands and installations and state financed or supported improvements. This Executive Order is still in effect and continues to provide a foundation for the state's floodplain management efforts, in conjunction with Executive Directive 2001-5 (see below).

EXECUTIVE ORDER 1998-5: A Michigan Executive Order issued by Governor John Engler on July 29, 1998 that established the Michigan Hazard Mitigation Coordinating Council (MHMCC) and assigned administrative functions associated with the council to the Emergency Management and Homeland Security Division, Department of State Police. (Note: Executive Order 2007-18 rescinded Executive Order 1998-5 and abolished the Michigan Hazard Mitigation Coordinating Council. See next definition below.)

EXECUTIVE ORDER 2007-18: A Michigan Executive Order issued by Governor Jennifer Granholm on May 2, 2007 that established the Michigan Citizen-Community Emergency Response Coordinating Council (MCCERCC) and assigned administrative functions associated with the council to the Emergency Management and Homeland Security Division, Department of State Police. The Michigan Citizen-Community Emergency Response Coordinating Council replaces the Michigan Citizen Corps Council, the Michigan Emergency Planning and Community Right-to-Know Commission, and the Michigan Hazard Mitigation Coordinating Council. The MCCERCC is responsible for developing and implementing emergency response and hazard mitigation plans for the state. The council also acts as the state emergency response commission as required by federal statute. (Note: Executive Order 2007-18 rescinded Executive Order 1998-5 and abolished the Michigan Hazard Mitigation Coordinating Council.)

EXECUTIVE DIRECTIVE 2001-5: A Michigan Executive Directive issued by Governor John Engler on September 11, 2001 that directed the Michigan Department of Environmental Quality, as the lead state agency, and the Michigan Hazard Mitigation Coordinating Council and various other state agencies to develop a statewide, interagency flood mitigation strategy to assure compliance with the State Flood Hazard Mitigation Plan (see Executive Order 1977-4 above). (Note: the Michigan Citizen-Community Emergency Response Coordinating Council has replaced the Michigan Hazard Mitigation Coordinating Council, per Executive Order 2007-18. See definition above.)

EXECUTIVE ORDERS 11988 AND 11990: The requirements to avoid direct or indirect support of floodplain development and to minimize harm to floodplains and wetlands. Federal decision-makers are obligated to comply with these orders, accomplished through an eight-step decision-making process.

EXECUTIVE ORDER 12699: Requires that new construction of Federal buildings must comply with appropriate seismic design and construction standards.

EXECUTIVE ORDER 12898: Requires Federal agencies to make environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States.

FACILITY: Any publicly or privately owned building, works, system, or equipment, built or manufactured, or an improved and maintained natural feature. Land used for agricultural purposes is not a facility.

FEDERAL COORDINATING OFFICER (FCO): The person appointed by the President to manage the federal response to a major disaster or emergency, including the provision of hazard mitigation assistance to a state.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA): The federal agency that coordinates emergency planning, preparedness, mitigation, response and recovery within the federal government. FEMA has been delegated primary responsibility for administering the President's Disaster Relief Program, which includes the Hazard Mitigation Grant Program (HMGP). FEMA also administers the Flood Mitigation Assistance Program (FMAP), Pre-Disaster Mitigation Program (PDMP), Repetitive Flood Claims Program (RFCP), and Severe Repetitive Loss Program (SRLP).

FEDERAL HAZARD MITIGATION OFFICER (FHMO): The FEMA employee responsible for representing the agency for each declaration in carrying out the overall responsibilities for hazard mitigation, including coordinating post-disaster hazard mitigation actions with other agencies of government at all levels.

FEDERAL-STATE AGREEMENT: The document that states the understandings, commitments, and conditions for assistance under which FEMA disaster assistance shall be provided. This agreement imposes binding obligations on FEMA, the State, and local governments in the form of conditions for assistance which are legally enforceable.

FINDING OF NO SIGNIFICANT IMPACT: A determination that an action will have no significant impact on the environment.

FLOOD MITIGATION ASSISTANCE PROGRAM (FMAP): A grant program created under the National Flood Insurance Reform Act of 1994 to provide mitigation planning and project grants to states and communities. The

program is funded through flood insurance policy fees. A maximum of $20 million in grant money is available annually.

FLOODPLAIN: The lowland and relatively flat areas adjoining inland or coastal waters including, at a minimum, that area subject to a one percent or greater chance of flooding in any given year (the "base flood" or "100-year flood).

FLOODPLAIN MANAGEMENT: An overall community program of corrective and preventive measures for reducing flood damage. These measures take a variety of forms and generally include zoning, subdivision or building requirements, or special purpose flood ordinances.

GRANT: An award of financial assistance.

GRANTEE: The government to which a grant is awarded and which is accountable for the use of the funds provided. The State of Michigan is the grantee for the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), Pre-Disaster Mitigation Program (PDMP), Repetitive Flood Claims Program (RFCP), and Severe Repetitive Loss Program (SRLP).

HAZARD MITIGATION: Any action taken to reduce or permanently eliminate the long-term risk to human life and property from natural, technological and human-related hazards.

HAZARD MITIGATION ASSISTANCE (HMA): An "umbrella" program that contains numerous sources of grant funds for hazard mitigation activities. Hazard Mitigation includes the following programs, which are themselves further described elsewhere in this plan (please refer to the subsection entitled "Funding Sources for Implementation of Mitigation Projects," found within the "Mitigation Strategy" section of this plan.)

HAZARD MITIGATION GRANT PROGRAM (HMGP): A grant program authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act that provides funding for hazard mitigation projects that are cost-effective and complement existing post-disaster mitigation programs and activities by providing funding for beneficial mitigation measures that are not funded through other programs.

HAZARD MITIGATION STATE ADMINISTRATIVE PLAN: The plan developed by the State to describe the procedures for administration of the Hazard Mitigation Grant Program and Flood Mitigation Assistance Program. These State Administrative Plans are separate, stand-alone support plans to the Michigan Hazard Mitigation Plan.

HAZARD MITIGATION STRATEGY: The report developed by the State, FEMA, other federal agencies, and affected local governments that identifies mitigation measures for implementation and recommends issues to be addressed in the State Hazard Mitigation Plan, including those measures recommended for funding under the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), Pre-Disaster Mitigation Program (PDMP), Repetitive Flood Claims Program (RFCP), Severe Repetitive Loss Program (SRLP), and other applicable programs. Hazard Mitigation Strategies developed for each Presidentially-declared disaster become addenda to the Michigan Hazard Mitigation Plan.

INTERAGENCY HAZARD MITIGATION TEAM (IHMT): The mitigation team that is activated following flood-related disasters pursuant to the Office of Management and Budget directive on Nonstructural Flood Protection Measures and Flood Disaster Recovery, and the subsequent December 15, 1980 Interagency Agreement for Nonstructural Damage Reduction.

LOCAL EMERGENCY MANAGEMENT COORDINATOR: The person appointed pursuant to 1976 PA 390, as amended, to coordinate emergency management activities for a county or municipal emergency management program. Also commonly called County or Local "Emergency Manager."

LOCAL GOVERNMENT:

a. Any county, city, village, town, district, regional authority, public college or university, or other political subdivision of any state, any Indian Tribe or authorized tribal organization, or Alaskan native village or organization; and

b. Any rural community or unincorporated town or village or any other public entity for which an application for assistance is made by a state or political subdivision.

MAJOR DISASTER: Any natural catastrophe (including any hurricane, tornado, storm, highwater, winddriven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought), or, regardless of cause, any flood, fire, or explosion, in any part of the United States which in the determination of the President cause damage of sufficient severity and magnitude to warrant major disaster assistance under the Stafford Act to supplement the efforts and available resources of states, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby.

MICHIGAN EMERGENCY MANAGEMENT PLAN (MEMP): The plan developed and continuously maintained by the Emergency Management and Homeland Security Division, Department of State Police, pursuant to 1976 PA

390, as amended, for the purpose of coordinating the emergency management activities of mitigation, preparedness, response and recovery within the state.

MICHIGAN CITIZEN-COMMUNITY EMERGENCY RESPONSE COORDINATING COUNCIL (MCCERCC): The body established on May 2, 2007 by Executive Order 2007-18 to replace the Michigan Hazard Mitigation Coordinating Council (see definition below), the Michigan Citizen Corps Council, and the Michigan Emergency Planning and Community Right-to-Know Commission. The MCCERCC is responsible for developing and implementing emergency response and hazard mitigation plans for the state. The council also acts as the state emergency response commission as required by federal statute. Executive Order 2007-18 assigned administrative functions associated with the MCCERCC to the Emergency Management and Homeland Security Division, Department of State Police.

MICHIGAN HAZARD MITIGATION COORDINATING COUNCIL (MHMCC): The body established by Executive Order 1998-5 and composed of representatives from key state agencies, local units of government, the planning industry, and the property and casualty insurance industry, which is responsible for evaluating hazards, identifying and developing strategies, coordinating resources, and implementing measures that will reduce the risk and vulnerability of people and property in Michigan from natural, technological and human-related hazards. (Note: Executive Order 2007-18 rescinded Executive Order 1998-5 and abolished the Michigan Hazard Mitigation Coordinating Council. See definition above.)

MICHIGAN HAZARD MITIGATION PLAN (MHMP): The plan developed and continuously maintained by the Emergency Management and Homeland Security Division, Department of State Police, which describes and coordinates the hazard mitigation activities of state agencies designed to reduce or eliminate the effects of disasters and emergency situations on Michigan citizens and communities.

MITIGATION MEASURE: Any mitigation project, activity, initiative or action proposed to reduce risk of future damage, hardship, loss, or suffering from disasters.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA): Public Law 91-190, as amended, which requires that actions affecting the environment comply with specific policies and procedures. NEPA requires that environmental information be available to public officials and citizens before decisions are made and actions are taken.

NATIONAL FLOOD INSURANCE PROGRAM (NFIP): The program established in 1968 under the National Flood Insurance Act to provide property owners in floodplains with federally-subsidized flood insurance in those communities that implement ordinances to reduce future flood losses. The National Flood Insurance Reform Act of 1994 revised and strengthened many aspects of the program.

PRELIMINARY DAMAGE ASSESSMENT (PDA): An assessment conducted by teams of federal, state and local officials to determine the severity and magnitude of a disaster and also to identify capabilities and resources of state, local and other federal agencies. Identification of hazard mitigation opportunities is a key part of the PDA process.

PRE-DISASTER MITIGATION PROGRAM (PDMP): The program authorized under Section 203 of the Stafford Act the provides funding to states and local communities for cost-effective hazard mitigation activities that complement a comprehensive mitigation program and reduce injuries, loss of life, and damage and destruction of property.

PROJECT: All mitigation work performed at a single site or multiple sites as described on a project summary.

PUBLIC ASSISTANCE: Federal financial assistance provided through the Public Assistance Grant Program (PAGP) to state and local governments or to eligible private nonprofit organizations for disaster-related requirements. Cost-effective hazard mitigation measures may be funded under the PAGP as part of public facility repair, restoration or reconstruction project.

RECORD OF ENVIRONMENTAL REVIEW: A document that is prepared for all Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), Pre-Disaster Mitigation Program (PDMP), Repetitive Flood Claims Program (RFCP), and Severe Repetitive Loss Program (SRLP) projects to detail that potential environmental concerns will be addressed. This document serves to determine if an Environmental Assessment is needed.

REPETITIVE FLOOD CLAIMS PROGRAM (RFCP): A grant program authorized by the Bunning-Berauter-Blumenauer Flood Insurance Reform Act of 2004 that provides funding to reduce or eliminate the long-term risk of flood damage to structures insured under the National Flood Insurance Program (NFIP) that have had one or more claim payments for flood damages. The long-term goal of RFCP is to reduce or eliminate claims under the NFIP through mitigation activities that are in the best interest of the National Flood Insurance Fund (NFIF). RFCP funds may only mitigate structures that are located within a State or community that can not meet the cost share or management capacity requirements of the Flood Mitigation Assistance Program (FMAP).

SECTION 404: The section of the Stafford Act that authorizes the Hazard Mitigation Grant Program (HMGP). The HMGP provides funding for cost-effective hazard mitigation measures.

SECTION 406: The section of the Stafford Act that authorizes the Public Assistance Grant Program (PAGP). This program provides grants to repair, restore, or replace damaged facilities belonging to public and private non-profit entities, and other associated expenses, including emergency protective measures and debris removal. Cost-effective hazard mitigation measures are eligible for funding under the PAGP.

SEVERE REPETITIVE LOSS PROGRAM (SRLP): A grant program authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 that provides funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss residential structures insured under the National Flood Insurance Program (NFIP). The definition of severe repetitive loss as applied to this program was established in section 1361A of the National Flood Insurance Act, as amended (NFIA), 42 U.S.C. 4102a. An SRL property is defined as a **residential property** that is covered under an NFIP flood insurance policy and:

a. That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or

b. For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.

STAFFORD ACT: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-707, signed into law November 23, 1988. The Stafford Act amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act was amended by the Disaster Mitigation Act (DMA) of 2000 (PL 106-390), signed into law on October 30, 2000.

STANDARDS: Codes, specifications or standards for the construction of facilities to include legal requirements for additional features.

STATE COORDINATING OFFICER (SCO): The person appointed by the Governor to manage all aspects of a federally-declared disaster, in cooperation with the Federal Coordinating Officer (FCO). The Division Commander or Assistant Division Commander of the Emergency Management and Homeland Security Division, Department of State Police is normally appointed to this position.

STATE HAZARD MITIGATION OFFICER (SHMO): The person appointed by the State Coordinating Officer to serve as the primary point of contact with FEMA, other federal and state agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities (including management of the Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, Pre-Disaster Mitigation Program, Repetitive Flood Claims Program, and Severe Repetitive Loss Program).

STATE INDIVIDUAL ASSISTANCE OFFICER (SIAO): The person appointed by the State Coordinating Officer to serve as the primary point of contact with FEMA, other federal and state agencies, and private, voluntary agencies and organizations in the provision of disaster relief assistance to individuals and families.

STATE PUBLIC ASSISTANCE OFFICER (SPAO): The person appointed by the State Coordinating Officer to manage the Public Assistance Grant Program on behalf of the State.

STATUTORY ADMINISTRATIVE COSTS: Under the Stafford Act, administrative costs for the preparation of applications for mitigation assistance, progress reports, audits, etc., are reimbursable based on a percentage of financial assistance received.

SUBGRANT: An award of financial assistance under a grant by a grantee to an eligible subgrantee.

SUBGRANTEE: The government or other legal entity to which a subgrant is awarded and which is accountable to the grantee for the use of the funds provided.

WET FLOODPROOFING: Permanent or contingent measures applied to a structure and/or its contents that automatically prevent or provide resistance to damage from flooding by intentionally allowing water to enter the structure. (Examples: Move all electrical outlets above expected flood levels; install floodwalls and protection closets around equipment [i.e., furnace, water heater] that cannot be relocated.)

WETLANDS: Those areas which are inundated or saturated by surface or ground water with a frequency sufficient to support, or that under normal hydrologic conditions does or would support, a prevalence of vegetation or aquatic life typically adapted for life in saturated or seasonally saturated soil conditions.